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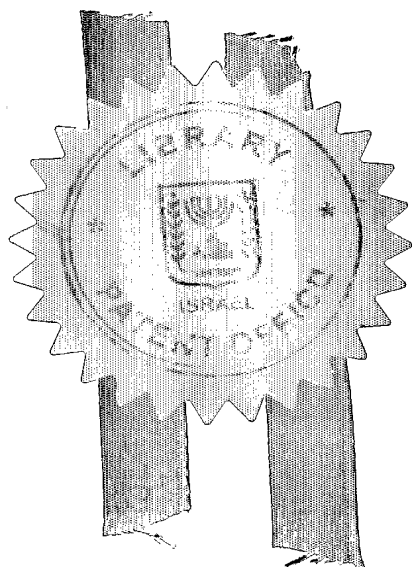
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PATENT APPLICATION

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(בעברית)
(Hebrew)

An Exercise and Mobilization Device for Motorically Handicapped Persons

(באנגלית)
(English)

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מכשיר שיקום וניוד עבור
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**An Exercise and Mobilization
Device for Motorically
Handicapped Persons**

An Exercise, Rehabilitation and Mobilization Device for Paraplegic and Motorically Handicapped Persons

BACKGROUND

The present invention relates in general to devices which enable paraplegic motorically handicapped people to perform exercises, and more specifically to devices which enable paraplegic and motorically handicapped people to perform passive and active walking exercises for rehabilitation and mobilization purposes,

It is a well known fact that performing walking exercises in an upright standing position is an essential part of the rehabilitation process of paraplegic, spinal and leg injury patients. In addition to restoring partial and full walking abilities passive and active walking exercises are important for the circulatory condition of the patient, to prevent spasticity and to restore muscular functionality of the legs and torso.

Known in the art are several devices designed to provide a solution for this need. Most commonly known is the moving belt exercising apparatus, where in walking is made possible for the patient by a full or a partial weight relief and by additional assisting guidance of the legs by physiotherapists. This apparatus is suited for patients whose circulatory condition enables them to remain in an upright position for substantial periods of time, and who may already perform a partially active walking exercise.

Several devices were designed to overcome these constraints. US Patent No 6,685,658, for example, describes an apparatus which actively moves the legs of a disabled person in a movement pattern that is similar to physiological walking. This apparatus is designed to aid

patients in their initial stages of rehabilitation and enables performing only passive walking exercises.

There are several shortcomings to this apparatus, which are also shared with other existing solutions: first, existing devices provide a solution to a particular stage of the therapeutic process, they are designed to allow either passive or active exercises; second, the harnessing and patient bodyweight supporting methods of these devices are very often cumbersome or very inconvenient; third, these devices may not be fully operated by the patient both in passive and in active modes, they do not enable the patients to passively or actively mobilize themselves, and finally, these devices, which are usually big and expansive, may only be found in rehabilitation institutes and are not suited for long-term home use.

There is therefore a need for a simple, low-cost passive and active walking exercise and rehabilitation device with a comfortable harnessing solution, which may be fully operated by the patients and may also allow them to mobilize themselves in their surroundings.

SUMMARY

The present invention discloses an exercise and mobilization device for paraplegic and motorically disabled people, enabling the user to shift from a sitting to an upright position and perform passive and active walking exercises. The device comprised of a construction of horizontal frame assembled on a vertical frame. The horizontal frame is situated on wheels and the vertical frame is supported and operated by pistons enabling said frame to move between an upright position and a reclining position. The seat of the device includes a back and arm rest mounted on said vertical frame wherein said seat supports the user when shifting between a seating and standing position. A control panel is located on the arm rest enabling the user to control the device for moving between a seating position and standing

position. Pulleys are positioned on the vertical frame and a pin is positioned at the horizontal frame. A wire is stretched between said pulleys and pin for controlling and supporting the saddle seat when shifting between a seating position and standing position. An electric motor adjusts the height of the seat in the upright standing position and footholds are fastened to the user foot. Said footholds are movable along track mounted on the horizontal frame enabling the user practice a walking-like motion of the legs along the track at the upright position. Pelvic and shoulder straps, which are attached to saddle seat, stabilize the user within the saddle seat.

The seat of the device takes the form of a saddle seat and includes a special supporting design shaped to fit the user's underside. A second control panel is located behind the seat enabling a second person to control the device. The device may also be operated using voice activation means. The wheels supporting the horizontal frame may also be electronically driven.

BRIEF DESCRIPTION OF THE DRAWINGS

The above, as well as other advantages of the present invention will become readily apparent to those skilled in the art from the following detailed description of a preferred embodiment when considered in the light of the accompanying drawings in which:

Figure 1 is a schematic illustration of the device in a seated position in accordance with the present invention;

Figure 2 is a schematic illustration of the device in an upright position in accordance with the present invention;

Figure 3 is a detailed illustration of the device in an upright position in accordance with the present invention;

Figure 4 is a detailed illustration of the device in an upright position without the leg motion generator apparatus in accordance to the present invention; Figure 4a is an illustration of the dismantled leg motion generator apparatus;

Figure 5 is a detailed illustration of the arm rest and control panel of the device in accordance with the present invention;

Figure 6 is a detailed illustration of the saddle seat and supporting straps of the device in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention is an exercise and mobilization device for paraplegic and motorically disabled people which can be fully self-operated by the user. The device enables the user to change from a sitting to an upright position, perform passive and active walking exercises and passively or actively mobilize the device. The design of the device overcomes many of the shortcomings of prior art regarding the harnessing and bodyweight supporting solutions and ease of use and may easily be adjusted to suit different needs and levels of user ability. In addition, the disclosed device is lightweight, and relatively small and potentially low cost and therefore may be suited for home as well as institutional use.

Figure 1 and Figure 2 illustrate the device 100 in its two basic positions: in the seated position (Figure 1) and in the upright standing position (Figure 2). Once seated in the device 100, user 110 may operate the device 100 to shift from the seated position to the standing position by pressing a button, by using voice commands or by using a joystick on the user control panel 125 which is situated on the arm rest 120. By using the user control panel 125 the user activates pistons 160, which are located on both sides of the device. As pistons 160 expand they push the vertical frame 130 away from the horizontal frame 140. The two

frames are connected at axis 135 and therefore as the pistons 160 expand acute angle α (see Figure 1) between the vertical frame 130 and the horizontal frame 140 up to a nearly right angle β (see Figure 2).

Wire 165 is stretched between pin 141, pulleys 142 and 143 and to motor 144. As the vertical frame 130 is pushed up, the distance between it and pin 141 increases. The segment of wire 165 between pin 141 and pulley 142 expands causing the distance between pulley 143 and motor 144 to decrease, pulling up pulley 143 which causes the saddle seat 170 and the user 110 in it to rise with it. As the vertical frame 130 reaches its upright position, the seat 170 is raised to support the user at the appropriate height (see Figure 2). This is a slow and gradual motion which can be fully controlled by the user. Motor 144 is used to adjust the height of saddle seat 170 in the standing position to the height of the user. Similarly, lowering the device back to its initial seated position is performed by contracting the length of pistons 160. In this case the weight of the saddle seat 170 and the user 110 in it causes the seat 170 to respectively return to its initial position.

Figure 3 is a fully detailed illustration of a frontal view of the device in the upright position. This figure clearly depicts the footholds 315a, 315b, the tracks 316a, 316b and the leg motion generator apparatus 310. The footholds 315a, 315b are fastened to the user's feet in order to hold the feet in place and to allow a walking-like motion along the arched tracks 316a, 316b. While the device is in the seated position or in transition between the seated position and the upright standing position the footholds 315a, 315b are secured in the center of tracks 316 allowing a natural 90° sitting position (see Figure 1). Once the user is in the upright position he or she may passively or actively perform walk exercises as their body is safely held in place. In the passive exercise mode, which is designed for paraplegic patients, the device operates the back and forth motion of the feet along the tracks 316. The shape of

the tracks 316 and of the motion produced by the device are designed to fully emulate a normal walking-like motion. In active exercise mode the footholds are free to be moved back and fourth along the tracks 316 by the users while their bodyweight is carried by the saddle seat 170. The mode of exercise and the speed and stride of the foothold motion, which may be fully controlled by the user via the user control panel 125, is produced by motor 320 which is situated at the far end of the tracks 316 .

As illustrated in Figure 4 and Figure 4a, the leg motion generator apparatus 310 may be disconnected from the device 100. This allows users to exercise standing and walking on the floor, while the device gives them balance and helps support their bodyweight. In this configuration the device operates as a supporting walking frame or as a walker.

The user control panel 125 is illustrated in Figure 5. It is situated in reach of the hand at the far end of the arm rest 120. In addition to allowing the user to turn the device on and off, change the seated position of the device to the upright standing position and control the foothold apparatus mode of operation, the user control panel 125 also enables the user to control and steer the motion of the device itself. As Figures 1 to 3 show the device is situated on four wheels 340 which allow the device to be mobilized. This allows the device to operate as an electric wheelchair both in it seated and in its upright position. The user control panel 125 also allows the user to lock the wheels of the device 340 to avoid undesirable movements during exercise or, on the other hand, to release the wheels so that the device may be moved around freely. Releasing the wheels is especially useful when the device is without the leg motion generator apparatus 310 and is used as a supporting walking frame. An additional control panel 330 is situated at the back of the device (see Figure 3), allowing a therapist or a caregiver to control the operation of the device.

The unique structure of the saddle seat 170 is illustrated in Figure 6. It comprises a saddle-like seat 600 with two pelvic straps 605 and two shoulder straps 615 attached to the back of the seat 610. The saddle seat 600 is especially designed to provide full support to the bodyweight of the user, both in sitting and in standing positions. It supports the user's body by providing support to the buttocks bones and the crutch from behind and from below. This design overcomes the shortcomings of prior art strapping and supporting solutions which cause major discomfort, especially in the standing position. The design allows most of the weight of the user in the standing position to be carried by the seat itself, and not by the straps. The pelvic straps 605 and the shoulder straps 615 main goal is to insure that the users are safely positioned in the seat; they do not carry their weight and thus do not apply any unnecessary pressure on their body.

What is claimed is:

1. An exercise and mobilization device for paraplegic and motorically disabled people, enabling the user to shift from a sitting to an upright position and perform passive and active walking exercises, said device comprised of
 - A construction of horizontal frame assembled with a vertical frame wherein the horizontal frame is situated on wheels and the vertical frame is supported and operated by pistons enabling said frame to move between an upright position and a reclining position.
 - A seat including a back and arm rest mounted on said vertical frame wherein said seat supports the user when shifting between a seating and standing position.
 - Control panel located on the arm rest enabling the user to control the device for moving between a seating position and standing position.
 - Pulleys positioned on the vertical frame and a pin positioned at the horizontal frame wherein a wire is stretched between said pulleys and pin for controlling/supporting the saddle seat position when shifting between a seating position and standing position;
 - Electric motor for adjusting the height of the seat in the upright standing position;
 - Footholds which are fastened to the user foot, said footholds are movable along track mounted on the horizontal frame enabling the user practice walking like motion along the track at the upright position;
 - Pelvic and shoulder straps attached to saddle seat for stabilizing user position within the saddle seat;

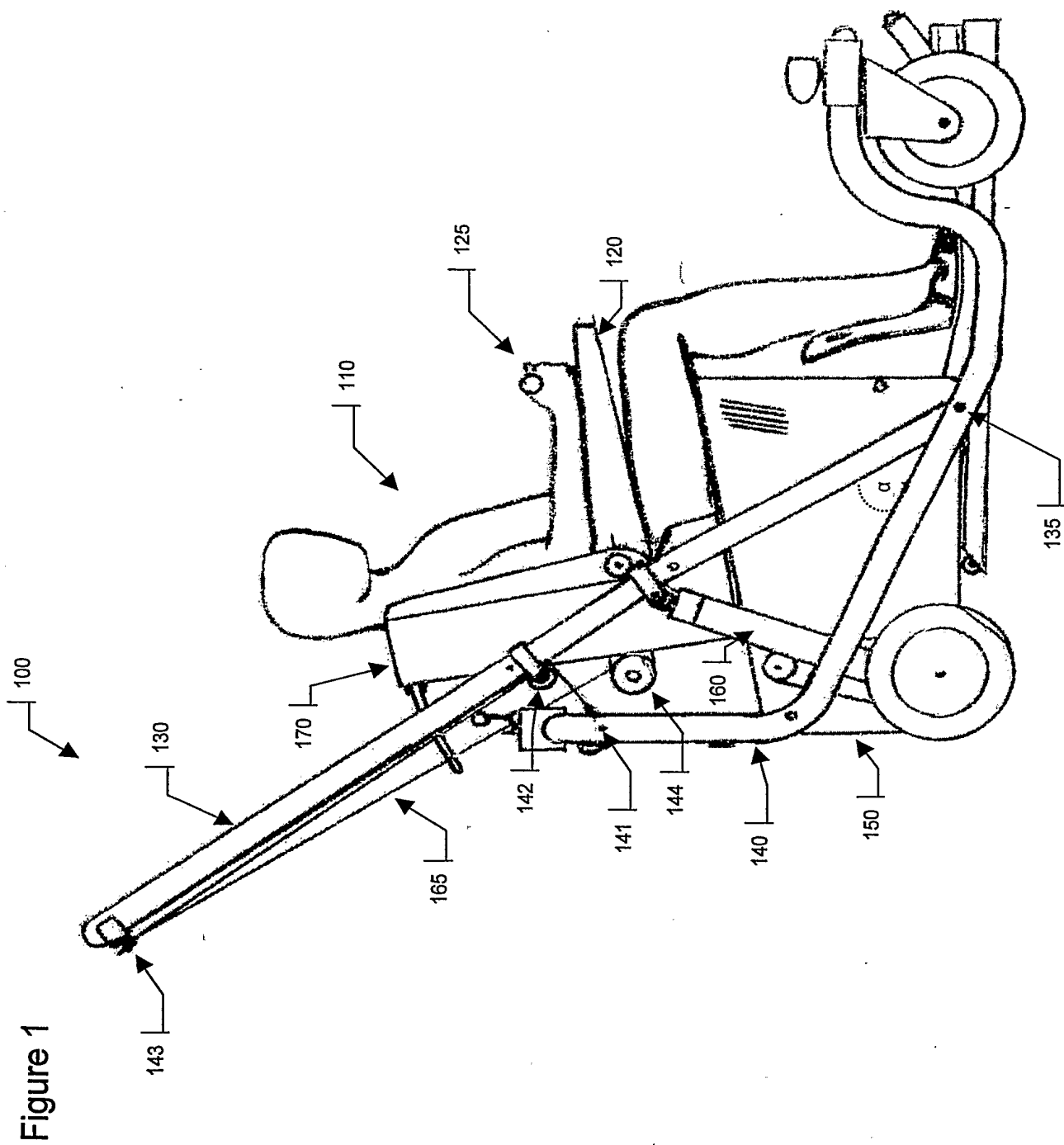
2. The device of claim 1 wherein the seat takes the form of a saddle seat and includes a special supporting design shaped to fit the user's underside.
3. The device of claim 1 further comprising a control panel behind the seat enabling a second person to control the device.
4. The device of claim 1 further comprising means for operating the device by voice activation commands;
5. The device of claim 1 wherein the wheels supporting the horizontal frame are electronically driven.

For the applicant

Yoram Zer, adv.

ABSTRACT

The present invention discloses a rehabilitation and exercise device for paraplegic and motorically disabled people. The device provides users with full support for reaching an upright standing position and enables them to passively or actively practice walking. While in the standing position the seat and the seat straps, which hold users in place, are shaped to support the users' underside to prevent causing unease and discomfort. A leg motion generator apparatus creates a walking-like motion for the legs of the user. The device which may be operated by the user using a control panel on the armrest, by a caretaker using a control panel on the back of the device or a via voice commands, is positioned on wheels and may also be used to mobilize the user.



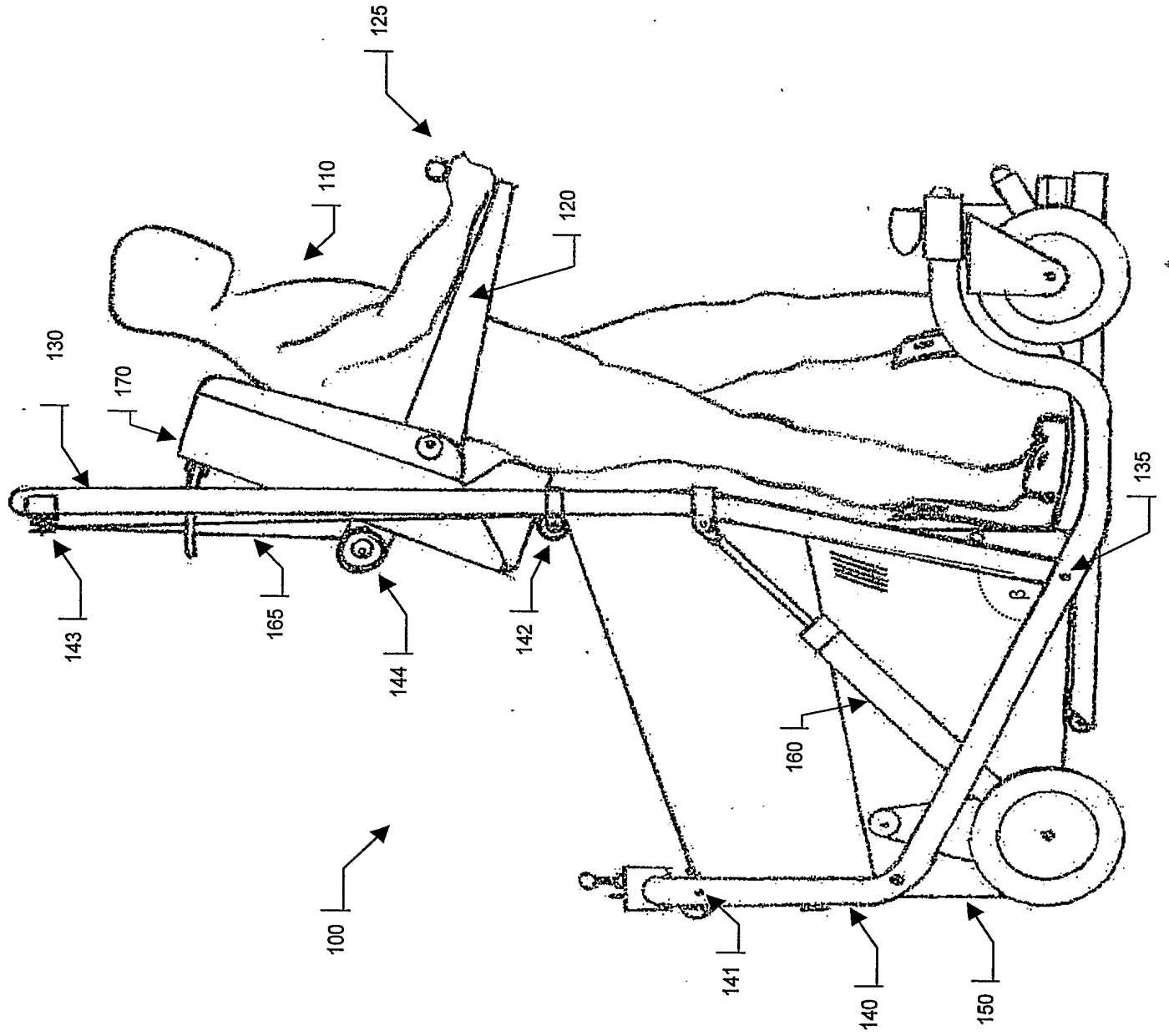
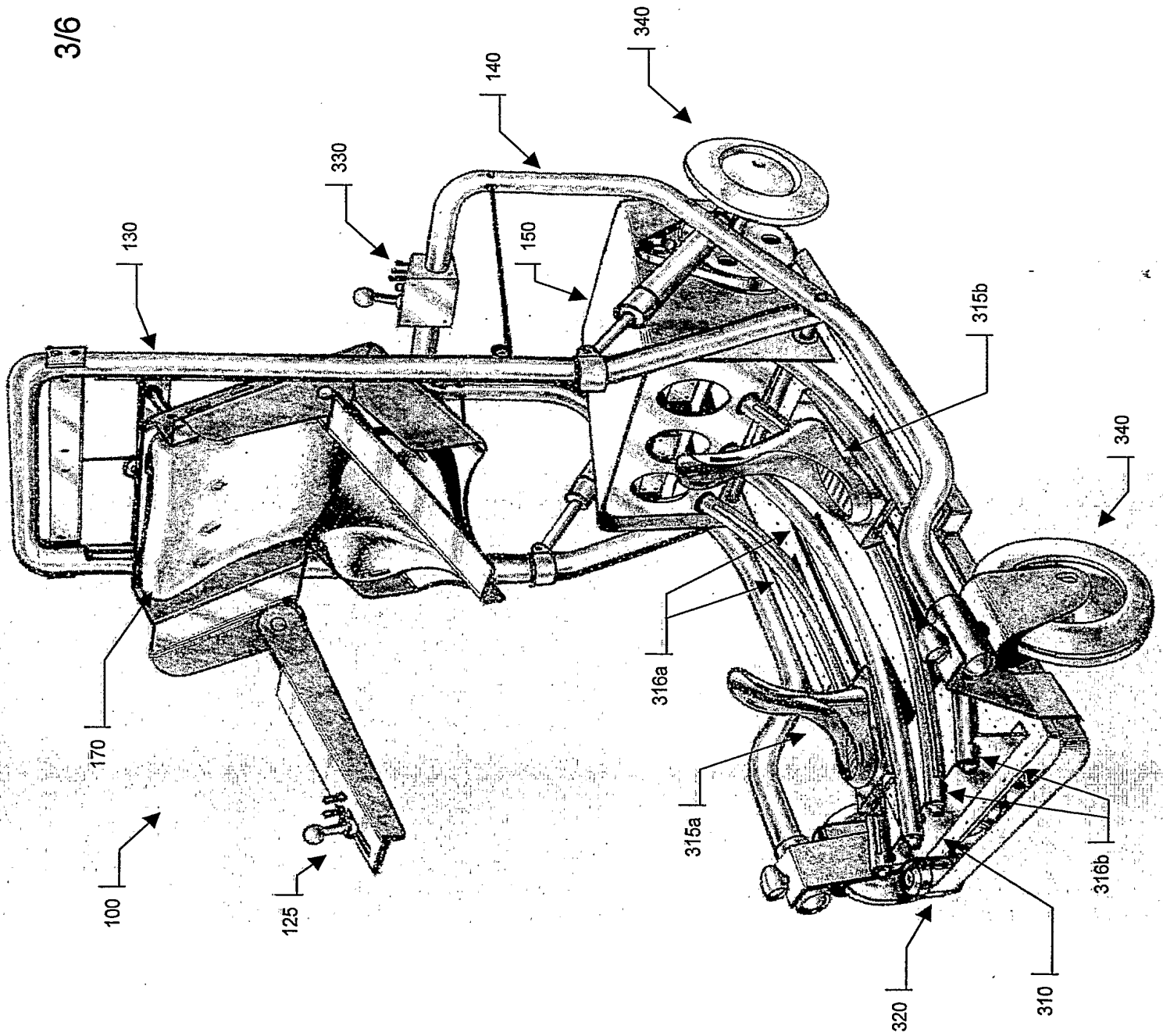


Figure 2

Figure 3



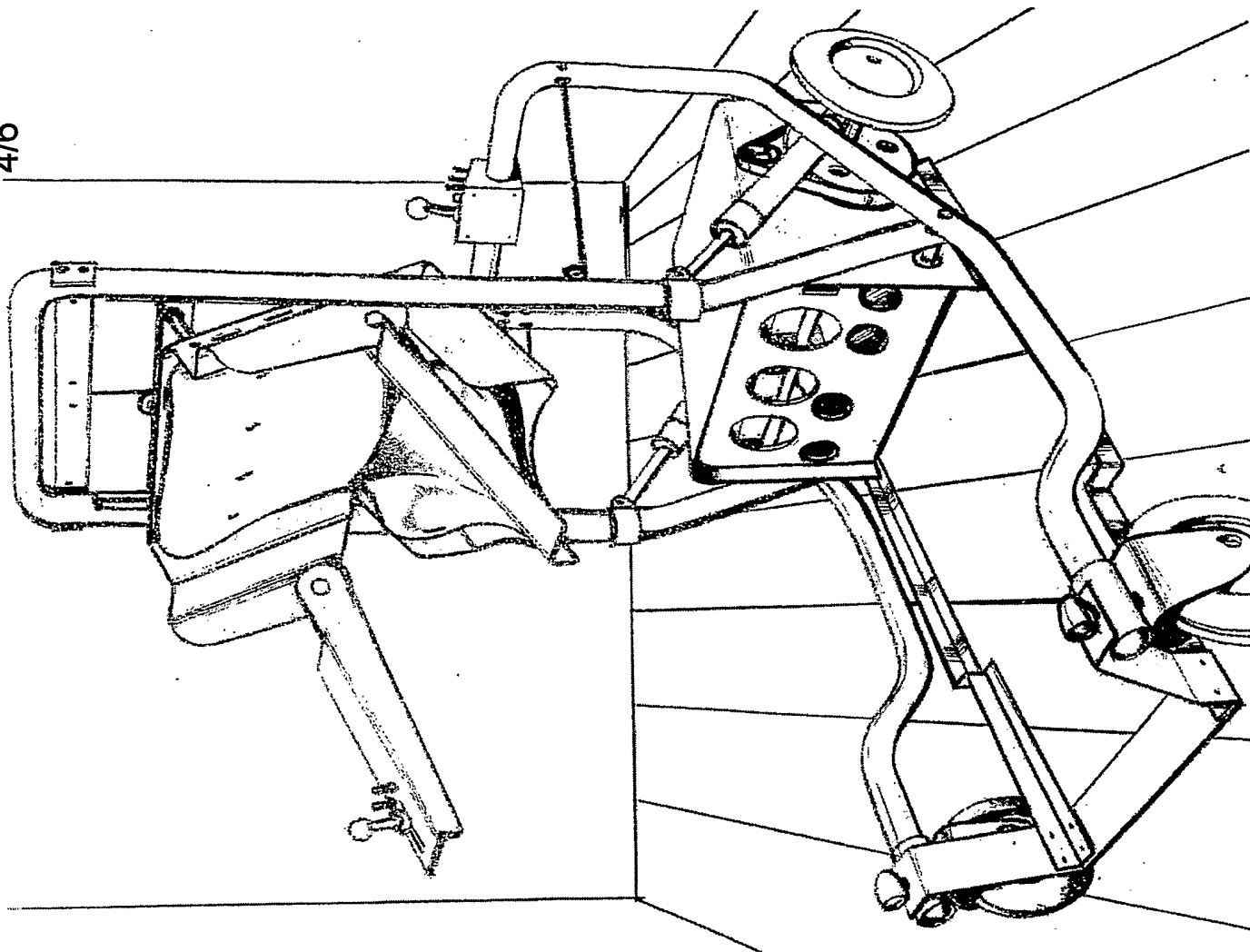


Figure 4

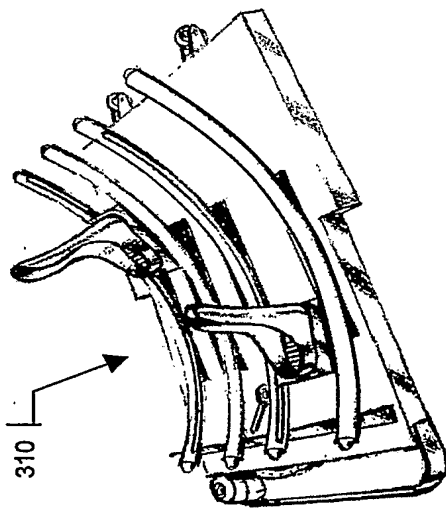


Figure 4a

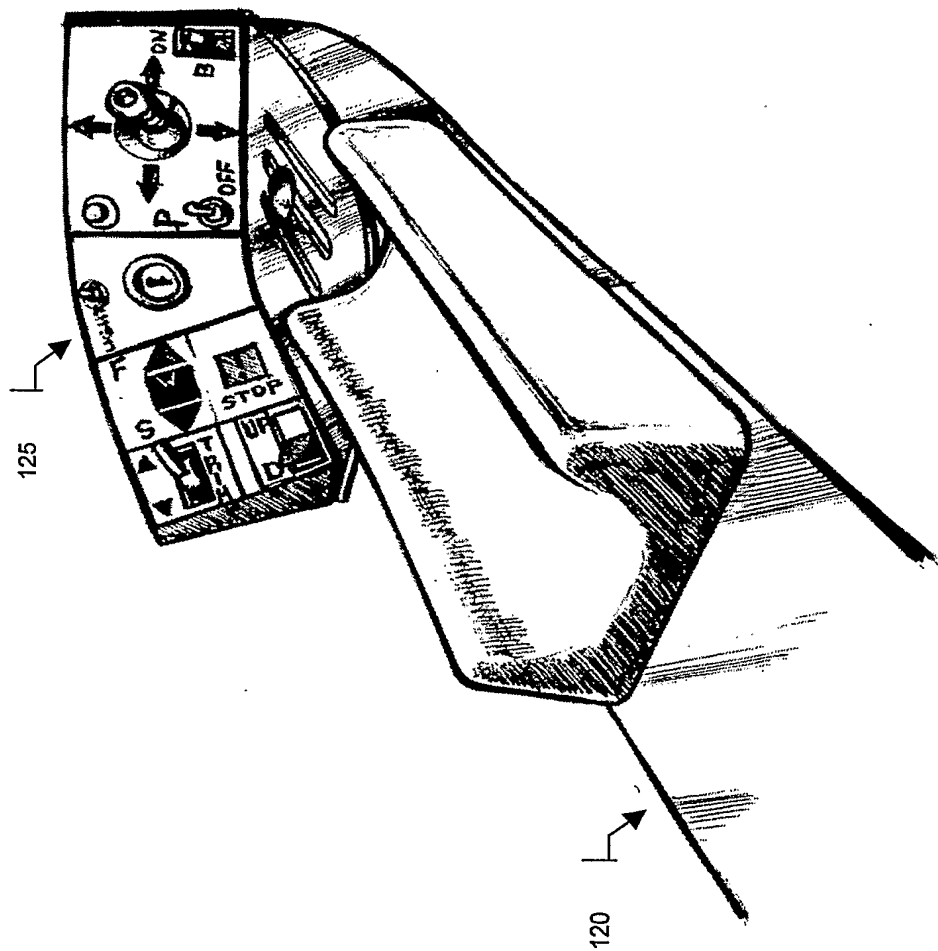


Figure 5

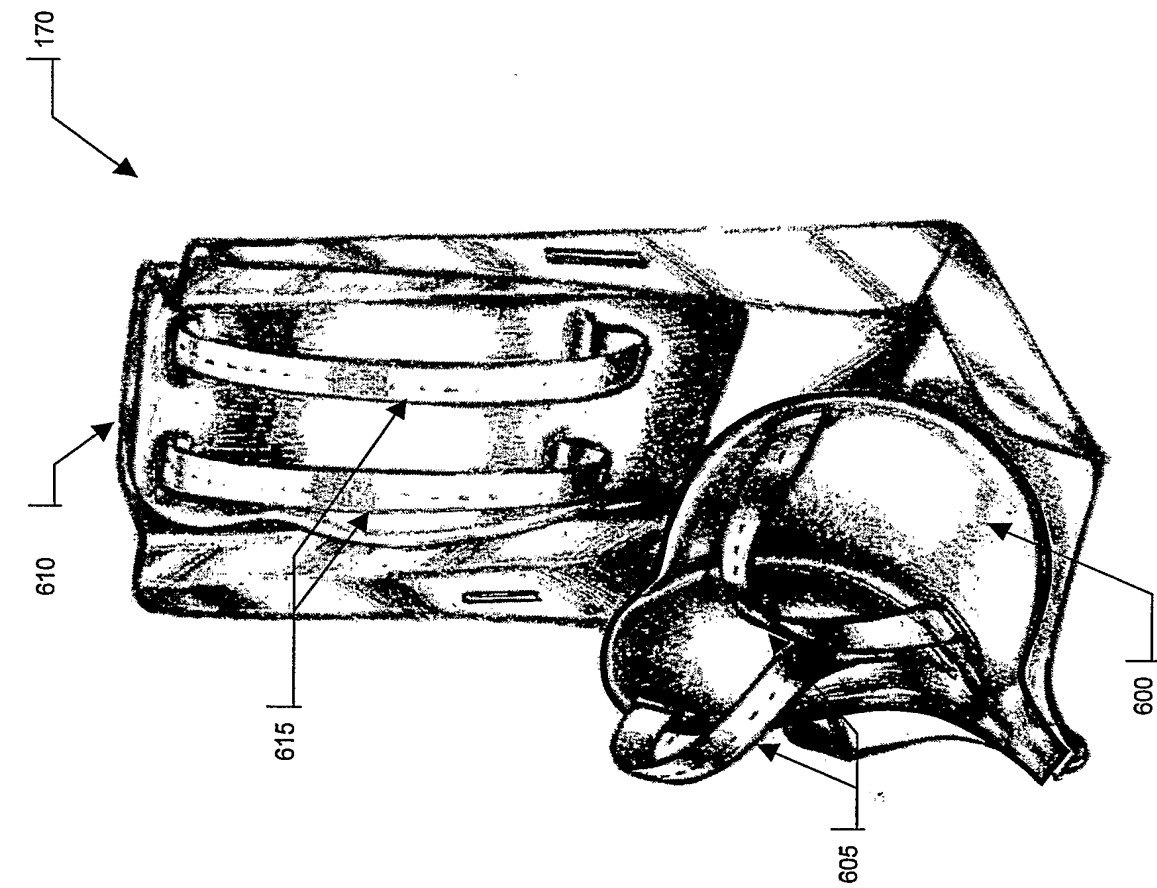


Figure 6